WHAT IS CLAIMED IS:

1.   A disk array device comprising:

a plurality of hard disk drives;

5   at least one channel control section having a plurality of ports that

are connectable to at least one information processing device via cables,

and that receives data input/output requests from the least one

information processing device to the plurality of hard disk drives;

at least one disk control section that is communicatably connected

10   to the plurality of hard disk drives and that sends data input/output

requests to the plurality of hard disk drives based on the data

input/output requests to the plurality of hard disk drives that are received

by the at least one channel control section; and

a shared memory that is accessible by the at least one channel

15   control section and the at least one disk control section for reading and

writing data therein,

wherein the shared memory stores a port control table that sets

control information indicating whether the plurality of ports are permitted

for use, and the at least one channel control section refers to the control

20   information set in the port control table and determines whether to

respond to a connection request regarding the ports received from the at

least one information processing device.

2. A disk array device according to claim 1, wherein

the control information includes the number of ports available for use among the plurality of ports,

the connection request includes a primitive sequence in a link

5 initialization processing for initializing linkage between the at least one information processing device and the plurality of ports,

the at least one channel control section stores in the port control table the number of ports whose linkage is initialized among the plurality of ports as the number of ports in use, and

10 upon receiving the primitive sequence in the link initialization processing, the at least one channel control section refers to the numbers of ports available for use and the number of ports in use stored in the port control table, wherein, when the number of ports in use is less than the number of ports available for use, the at least one channel control section

15 sends to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing; and when the number of ports in use is equal to or greater than the number of ports available for use, the at least one channel control section does not send to the at least one information processing device a

20 primitive sequence in response to the primitive sequence in the link initialization processing.

3. A disk array device according to claim 1, wherein

46

the at least one channel control section includes a plurality of

protocol processors that control the plurality of ports,

the control information includes the number of protocol processors

available for use among the plurality of protocol processors,

5   the connection request includes a primitive sequence in a link

initialization processing for initializing linkage between the at least one

information processing device and the plurality of ports,

the at least one channel control section registers in the port control

table specified protocol processors among the plurality of protocol

10   processors that control ports whose linkage is initialized among the

plurality of ports as protocol processors in use,

the channel control section stores in the port control table the

number of the protocol processors in use, and

upon receiving the primitive sequence in the link initialization

15   processing, the at least one channel control section refers to the port

control table and determines whether the protocol processors that control

the plurality of ports are the protocol processors in use,

wherein, when the protocol processors that control the ports are the

protocol processors in use, the at least one channel control section sends to

20   the at least one information processing device a primitive sequence in

response to the primitive sequence in the link initialization processing;

and

when the protocol processors that control the ports are not the

protocol processors in use, the at least one channel control section refers to

47

the number of the protocol processors available for use and the number of

protocol processors in use stored in the port control table, wherein, when

the number of the protocol processors in use is less than the number of the

protocol processors available for use, the at least one channel control

5　　　section sends to the at least one information processing device a primitive

sequence in response to the primitive sequence in the link initialization

processing, and when the number of the protocol processors in use is equal

to or greater than the number of the protocol processors available for use,

the at least one channel control section does not send to the at least one

10　　information processing device a primitive sequence in response to the

primitive sequence in the link initialization processing.

4.　　　A disk array device according to claim 1, wherein

the at least one channel control section includes a plurality of port

15　　groups each consisting of a set of plural ports among the plurality of ports,

the control information includes the number of port groups

available for use,

the connection request includes a primitive sequence in a link

initialization processing for initializing linkage between the at least one

20　　information processing device and the plurality of ports,

the at least one channel control section registers in the port control

table specified port groups among the port groups that include ports whose

linkage is initialized among the plurality of ports as port groups in use,

the channel control section stores in the port control table the

number of the port groups in use, and

upon receiving the primitive sequence in the link initialization

processing, the at least one channel control section refers to the port

5   control table and determines whether the port groups that include the

plurality of ports are the port groups in use,

wherein, when the port groups that include the plurality of ports

are the port groups in use, the at least one channel control section sends to

the at least one information processing device a primitive sequence in

10   response to the primitive sequence in the link initialization processing;

and

when the port groups that include the plurality of ports are not the

port groups in use, the at least one channel control section refers to the

number of the port groups available for use and the number of port groups

15   in use stored in the port control table, wherein, when the number of port

groups in use is less than the number of port groups available for use, the

at least one channel control section sends to the at least one information

processing device a primitive sequence in response to the primitive

sequence in the link initialization processing, and when the number of

20   port groups in use is equal to or greater than the number of port groups

available for use, the at least one channel control section does not send to

the at least one information processing device a primitive sequence in

response to the primitive sequence in the link initialization processing.

5.   A disk array device according to claim 1, further comprising a plurality of packages each having a substrate with a circuit formed thereon for realizing the channel control section,

wherein the control information includes the number of packages available for use,

the connection request includes a primitive sequence in a link initialization processing for initializing linkage between the at least one information processing device and the plurality of ports,

the at least one channel control section registers in the port control table specified packages among the plurality of packages that include ports whose linkage is initialized among the plurality of ports as packages in use,

the channel control section stores in the port control table the number of the packages in use, and

upon receiving the primitive sequence in the link initialization processing, the at least one channel control section refers to the port control table and determines whether the packages that include the plurality of ports are the packages in use,

wherein, when the packages that include the plurality of ports are the packages in use, the at least one channel control section sends to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing; and

when the packages that include the plurality of ports are not the

packages in use, the at least one channel control section refers to the

number of the packages available for use and the number of packages in

use stored in the port control table, wherein, when the number of packages

5   in use is less than the number of packages available for use, the at least

one channel control section sends to the at least one information

processing device a primitive sequence in response to the primitive

sequence in the link initialization processing, and when the number of

packages in use is equal to or greater than the number of packages

10   available for use, the at least one channel control section does not send to

the at least one information processing device a primitive sequence in

response to the primitive sequence in the link initialization processing.

6.   A disk array device according to claim 1, wherein

15   the control information includes the number of logical paths

available for use with the at least one information processing device,

the connection request includes a request to establish logical paths

with the at least one information processing device,

the at least one channel control section registers in the port control

20   table the number of logical paths that have been established as the

number of logical paths in use, and

upon receiving the request to establish logical paths, the at least

one channel control section refers to the number of logical paths available

for use and the number of logical paths in use stored in the port control

table,

wherein, when the number of logical paths in use is less than the

number of logical paths available for use, the at least one channel control

5 section responds to the request to establish logical paths and establish the

logical paths, and

when the number of logical paths in use is equal to or greater than

the number of logical paths available for use, the at least one channel

control section does not respond to the request to establish logical paths.

10

7. A disk array device according to claim 1, wherein

the control information indicates an availability of the plurality of

ports,

the connection request includes a primitive sequence in a link

15 initialization processing for initializing linkage between the at least one

information processing device and the plurality of ports,

the at least one channel control section includes at least one

channel processor that governs the overall control of the channel control

section, at least one protocol processor that controls the plurality of ports,

20 and a register that is referred to by the at least one protocol processor,

the at least one channel processor refers to the availability of the

ports stored in the port control table, and sets the availability of the ports

in the register, and

upon receiving the primitive sequence in the link initialization

processing, the at least one protocol processor refers to the register,

wherein, when the ports are permitted to be used, the at least one protocol

processor sends to the at least one information processing device a

5   primitive sequence in response to the primitive sequence in the link

initialization processing; and when the ports are not permitted to be used,

the at least one protocol processor does not send to the at least one

information processing device a primitive sequence in response to the

primitive sequence in the link initialization processing.

10

8.   A disk array device according to claim 1, wherein

the at least one channel control section includes at least one

channel processor that governs the overall control of the channel control

section, at least one protocol processor that controls the plurality of ports,

15   and a register that is referred to by the at least one protocol processor,

the control information indicates an availability of the at least one

protocol processor,

the connection request includes a primitive sequence in a link

initialization processing for initializing linkage between the at least one

20   information processing device and the plurality of ports,

the at least one channel processor refers to the availability of the at

least one protocol processor stored in the port control table, and sets the

availability of the at least one protocol processor in the register, and

53

upon receiving the primitive sequence in the link initialization

processing, the at least one protocol processor refers to the register,

wherein, when the at least one protocol processor is permitted to be used,

the at least one protocol processor sends to the at least one information

5   processing device a primitive sequence in response to the primitive

sequence in the link initialization processing; and when the at least one

protocol processor is not permitted to be used, the at least one protocol

processor does not send to the at least one information processing device a

primitive sequence in response to the primitive sequence in the link

10   initialization processing.

9.   A disk array device according to claim 1, wherein

the at least one channel control section includes at least one

channel processor that governs the overall control of the channel control

15   section, at least one protocol processor that controls the plurality of ports,

a register that is referred to by the at least one protocol processor, and at

least one port group including sets of the plurality of ports,

the control information indicates an availability of the at least one

port group,

20   the connection request includes a primitive sequence in a link

initialization processing for initializing linkage between the at least one

information processing device and the plurality of ports,

the at least one channel processor refers to the availability of the at

least one port group stored in the port control table, and sets the

availability of the at least one port group in the register, and

upon receiving the primitive sequence in the link initialization

5   processing, the at least one protocol processor refers to the register,

wherein, when the at least one port group is permitted to be used, the at

least one protocol processor sends to the at least one information

processing device a primitive sequence in response to the primitive

sequence in the link initialization processing; and when the at least one

10   port group is not permitted to be used, the at least one protocol processor

does not send to the at least one information processing device a primitive

sequence in response to the primitive sequence in the link initialization

processing.

15   10.   A disk array device according to claim 1, wherein

the at least one channel control section includes a plurality of

packages each having a substrate with a circuit formed thereon for

realizing the channel control section,

the at least one channel control section includes at least one

20   channel processor that governs the overall control of the channel control

section, at least one protocol processor that controls the plurality of ports,

and a register that is referred to by the at least one protocol processor,

the control information indicates an availability of the packages,

55

the connection request includes a primitive sequence in a link

initialization processing for initializing linkage between the at least one

information processing device and the plurality of ports,

the at least one channel processor refers to the availability of the

5   packages stored in the port control table, and sets the availability of the

packages in the register, and

upon receiving the primitive sequence in the link initialization

processing, the at least one protocol processor refers to the register,

wherein, when the packages are permitted to be used, the at least one

10   protocol processor sends to the at least one information processing device a

primitive sequence in response to the primitive sequence in the link

initialization processing; and when the packages are not permitted to be

used, the at least one protocol processor does not send to the at least one

information processing device a primitive sequence in response to the

15   primitive sequence in the link initialization processing.

11.   A disk array device according to claim 2, further comprising a

management terminal that is communicatably connectable, wherein

the management terminal includes a user interface that notifies the

20   at least one channel control section of a change in the number of ports

available for use, and

upon receiving a request to change the number of ports available for

use from the management terminal, the at least one channel control

section changes the number of ports available for use stored in the port

control table, and refers to the number of ports in use stored in the port

control table,

wherein, when the number of ports available for use is equal to or

greater than the number of ports in use, and there are connected/not

5   operating ports among the plurality of ports that are connected to the

cables but whose linkage is not initialized, the at least one channel control

section sends to the at least one information processing device a primitive

sequence in the link initialization processing for the connected/not

operating ports in a number less than a difference between the number of

10   ports in use and the number of ports available for use, and

when the number of ports available for use is less than the number

of ports in use, the at least one channel control section sends to the at

least one information processing device a primitive sequence in a link

disconnection processing for ports among the plurality of ports whose

15   linkage is initialized such that the number of ports in use becomes equal

to the number of ports available for use.

12.   A disk array device according to claim 2, further comprising

a management terminal that is communicatably connectable, wherein

20   the management terminal includes a user interface that designates

a port number of a first port among the plurality of ports whose linkage is

initialized, and a second port number of a port that is connected to the

cable but whose linkage is not initialized, and that notifies the at least one

channel control section of a switching request to switch the first port and the second port, and

upon receiving the switching request, the at least one channel control section sends to the information processing device a primitive

5   sequence in a link disconnection processing for the first port whose linkage is initialized, and sends to the information processing device a primitive sequence in the initialization processing for the second port that is connected but whose linkage is not initialized.

10   13.   A disk array device according to claim 2, wherein the number of ports available for use is set in each of a plurality of time zones, and

the channel control section refers to the number of ports available for use and the number of ports in use in a time zone that includes the

15   current time among the plurality of time zones,

wherein, when the number of ports available for use is equal to or greater than the number of ports in use, and there are connected/not operating ports among the plurality of ports that are connected to the cables but whose linkage is not initialized, the at least one channel control

20   section sends to the at least one information processing device a primitive sequence in the link initialization processing for the connected/not operating ports in a number less than a difference between the number of ports in use and the number of ports available for use, and

when the number of ports available for use is less than the number

of ports in use, the at least one channel control section sends to the at

least one information processing device a primitive sequence in a link

disconnection processing for ports among the plurality of ports whose

5   linkage is initialized such that the number of ports in use becomes equal

to the number of ports available for use.

14.   A disk array device according to claim 1, further comprising

a management terminal that is communicatably connectable, wherein the

10   management terminal includes an interface that sets in the port control

table the control information that is one of the number of ports available

for use, the number of protocol processors available for use, the number of

port groups available for use, the number of packages available for use,

the number of logical paths available for use, an availability of each of a

15   plurality of port groups, and an availability of each of a plurality of

packages.

15.   A disk array device according to claim 1, further comprising a

management terminal that is communicatably connectable,

20   wherein the shared memory includes a performance monitoring

table that sets a measurement time interval for measuring a port usage

rate of each of the plurality of ports, and a port usage rate threshold with

respect to the port usage rate,

the at least one channel control section measures the port usage

rates of the plurality of ports in the measurement time intervals set in the

performance monitoring table, stores the port usage rates of the plurality

of ports in the performance monitoring table, and informs the

5   management terminal of any of the plurality of ports having the port

usage rates exceeding the corresponding respective port usage rate

thresholds.

16.   A disk array device according to claim 15, wherein the

10   management terminal includes a user face interface that designates each

of the plurality of ports and each of the measurement time intervals,

obtains from the performance monitoring table a port usage rate of the

port designated during the measurement time interval designated, and

displays the port usage rate obtained.

15

17.   A method for controlling a disk array device, the disk array

device comprising a plurality of hard disk drives, at least one channel

control section having a plurality of ports that are connectable to at least

one information processing device via cables, and that receives a data

20   input/output request from the least one information processing device to

the plurality of hard disk drives, at least one disk control section that is

communicatably connected to the plurality of hard disk drives and that

sends a data input/output request to the plurality of hard disk drives

based on the data input/output request to the plurality of hard disk drives

that is received by the at least one channel control section, and a shared

memory that is accessible by the at least one channel control section and

the at least one disk control section for reading and writing data therein,

wherein the shared memory stores a port control table that sets control

5   information indicating whether the plurality of ports are permitted for use,

the method comprising the steps conducted by the at least one channel

control section:

referring to the control information set in the port control table; and

determining whether to respond to a connection request regarding

10   the ports received from the at least one information processing device.

18.   A method for controlling a disk array device according to

claim 17, wherein the control information includes the number of ports

available for use among the plurality of ports, and the connection request

15   includes a primitive sequence in a link initialization processing for

initializing linkage between the at least one information processing device

and the plurality of ports, and further comprising the steps conducted by

the at least one channel control section of:

storing in the port control table the number of ports whose linkage

20   is initialized among the plurality of ports as the number of ports in use;

receiving the primitive sequence in the link initialization processing

through the plurality of ports;

referring to the numbers of ports available for use and the number

of ports in use stored in the port control table;

sending to the at least one information processing device a primitive

sequence in response to the primitive sequence in the link initialization

processing when the number of ports in use is less than the number of

ports available for use; and

5   not sending to the at least one information processing device a

primitive sequence in response to the primitive sequence in the link

initialization processing when the number of ports in use is equal to or

greater than the number of ports available for use.

10   19. A method for controlling a disk array device according to

claim 17, wherein the control information indicates an availability of the

plurality of ports, the connection request includes a primitive sequence in

a link initialization processing for initializing linkage between the at least

one information processing device and the plurality of ports, and the at

15 least one channel control section includes at least one channel processor

that governs the overall control of the channel control section, at least one

protocol processor that controls the plurality of ports, and a register that is

referred to by the at least one protocol processor, and the method

comprising the steps conducted by the at least one channel processor of:

20   referring to the availability of the ports stored in the port control

table; and

   setting the availability of the ports in the register,

and the steps conducted by the at least one protocol processor of

receiving the primitive sequence in the link initialization

processing;

referring to the availability of the ports sent in the register;

sending to the at least one information processing device a primitive

5   sequence in response to the primitive sequence in the link initialization

processing, when the ports are permitted to be used; and

not sending to the at least one information processing device a

primitive sequence in response to the primitive sequence in the link

initialization processing when the ports are not permitted to be used.

10

20.   A disk array device comprising:

a plurality of hard disk drives;

at least one channel control section having a plurality of ports that

are connectable to at least one information processing device via fiber

15   cables, and that receives data input/output requests from the at least one

information processing device to the plurality of hard disk drives;

at least one disk control section that is communicatably connected

to the plurality of hard disk drives and that sends data input/output

requests to the plurality of hard disk drives based on the data

20   input/output requests to the plurality of hard disk drives that are received

by the at least one channel control section;

a shared memory that is accessible by the at least one channel

control section and the at least one disk control section for reading and

writing data therein;

a cache memory that is used by the at least one channel control section and the at least one disk control section to temporarily store data in association with the data input/output request; and

a management terminal that is communicatably connectable,

5   wherein the channel control section includes

at least one protocol processor that is communicatably connected to the plurality of ports, and controls sending and receiving data to and from the information processing device,

at least one channel processor that is communicatably connected to

10   the at least one protocol processor, the shared memory and the cache memory, and governs the overall control of the channel control section, and

a local memory that is communicatably connected to the at least one channel processor and is accessed by the at least one channel processor to

15   read and write data therein,

the management terminal sets in the port control table the number of ports available for use among the plurality of ports,

the at least one channel processor stores in the port control table the number of ports in use that are permitted to be used among the

20   plurality of ports,

the at least one protocol processor inquires the at least one channel processor of an availability of the ports, when connecting the fiber cables to the ports and upon receiving a primitive sequence in a link initialization through the ports,

the at least one channel processor refers to the number of ports available for use and the number of ports in use stored in the port control table, notifies the at least one protocol processor of a permission to use the ports when the number of ports in use is less than the number of ports

5   available for use, and notifies the at least one protocol processor of a prohibition to use the ports when the number of ports in use is equal to or greater than the number of ports available for use, and

the at least one protocol processor initializes linkages in response to the primitive sequence in the link initialization processing upon receiving

10   a notification of the permission to use from the at least channel processor, and does not respond to the primitive sequence in the link initialization upon receiving a notification of the prohibition to use.